IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appellant:	Minwen JI	§	Confirmation No.:	9836
Serial No.:	10/687,798	§	Group Art Unit:	2616
Filed:	10/17/2003	§	Examiner:	Gary Mui
For:	Traffic Flow Management Through A Multipath Network	§	Docket No.:	200300737-1

APPEAL BRIEF

Mail Stop Appeal Brief – Patents
Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Date: August 11, 2008

Sir:

Appellant hereby submits this Appeal Brief in connection with the above-identified application. A Notice of Appeal was electronically filed on June 11, 2008.

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I. REAL PARTY IN INTEREST

The real party in interest is Hewlett-Packard Development Company, L.P. (HPDC), a Texas Limited Partnership, having its principal place of business in Houston, Texas. HPDC is a wholly owned affiliate of Hewlett-Packard Company (HPC). The Assignment from the inventor to HPDC was recorded on October 17, 2003, at Reel/Frame 014626/0133.

II. RELATED APPEALS AND INTERFERENCES

Appellant is unaware of any related appeals or interferences.

III. STATUS OF THE CLAIMS

Originally filed claims:	1-29.
Claim cancellations:	17, 18 and 28.
Added claims:	None.
Presently pending claims:	1-16, 19-27 and 29.
Presently allowed claims:	27 and 29.
Presently appealed claims:	1-16 and 19-26.

IV. STATUS OF THE AMENDMENTS

No claims were amended after the final Office Action dated March 18, 2008.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

In computer networks, data is transferred in packets between source and destination devices via one or more routers. Such packets may be routed through any one or more paths from source to destination. Appellant's contribution is in the area of how to assign paths in a way that addresses issues of variable packet loss rates among different paths, etc.[1]

The invention of claim 1 is directed to a method[2] for managing traffic flow through a multipath network.[3] The method comprises forwarding a packet along a first link of the multipath network,[4] tracking a load of the first link subsequent to forwarding the packet,[5] and preserving the first link for a subsequent packet having the same flow address as the forwarded packet upon determining a desired load change of the first link is less than a predetermined value.[6]

The invention of claim 9 comprises a computer-readable storage medium[7] comprising program instructions[8] that are executable by a processor[9] and that cause the processor to adjust positions of one or more pointers used to partition traffic flow through a multipath network.[10] The positions of the one or more pointers are variable relative to a range of hash units that correspond to flow addresses within the multipath network.[11]

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[1] See Appellant's Disclosure p. 1 line 1 of para. [0002] through p. 3 line 12 of para. [0006].

[2] Fig. 5. See Appellant's Disclosure p. 15 line 2 of para. [0040]

[3] Figs. 1 and 2. See Appellant's Disclosure p. 5 lines 3-4 of para. [0019].

[4] Fig. 5, step 40. See Appellant's Disclosure p. 15 line 2 of para. [0040].

[5] Fig. 5, step 42. See Appellant's Disclosure p. 15 line 8 of para. [0040].

[6] Fig. 5, steps 44/46. See Appellant's Disclosure p. 15 line 1 of para. [0041] and p. 16 line 2.

[7] Fig. 2, 20. See Appellant's Disclosure p. 7 line 2 of para. [0023]

[8] Fig. 2, 22. See Appellant's Disclosure p. 7 line 3 of para. [0023]

[9] Fig. 2, 24. See Appellant's Disclosure p. 7 line 3 of para. [0023]

[10] Figs. 3a, 3b. See Appellant's Disclosure p. 8 line 1; p. 10 line 1 of para. [0030].

[11] Figs. 3a, 3b. See Appellant's Disclosure p. 8 line 1; p. 10 line 1 of para. [0030].

The invention of claim 16 is directed to a router[12] that comprises multiple ports[13] for coupling to links of a network. The router comprises storage medium[14] having program instructions[15] executable using a processor[16] for selectively directing a data packet to one of the multiple ports and altering one or more of the conditions by which the data packet is selectively directed.[17] The one or more conditions comprise hash number values of one or more variable pointers configured to partition a range of hash numbers associated with possible flow addresses of the data packet.[18]

The invention of claim 23 comprises multiple stations[19] configured to send and receive data packets. A plurality of routers[20] is interposed between the multiple stations and interconnected by a mesh of links. Each router is configured to selectively direct a first packet along a link coupled thereto[21] in accordance with one or more variable pointers included within the router, and record the status[22] of the one or more variable pointers to direct a second packet having the same source and flow addresses as the first packet along the same link.[23] The one or more variable pointers are configured to partition a range of hash numbers associated with possible flow addresses of the data packets.[24]

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[12] Fig. 2. See Appellant's Disclosure p. 7 line 1 of para. [0023].

[13] Fig. 2, ports 26, 28. See Appellant's Disclosure p. 7 lines 5-6 of para. [0023].

[14] Fig. 2, 20. See Appellant's Disclosure p. 7 line 2 of para. [0023]

[15] Fig. 2, 22. See Appellant's Disclosure p. 7 line 3 of para. [0023]

[16] Fig. 2, 24. See Appellant's Disclosure p. 7 line 3 of para. [0023]

[17] Figs. 3a, 3b. See Appellant's Disclosure p. 8 line 1; p. 10 line 1 of para. [0030].

[18] Figs. 3a, 3b. See Appellant's Disclosure p. 8 line 1; p. 10 line 1 of para. [0030].

[19] Fig. 1, stations 12. See Appellant's Disclosure p. 6 lines 1-2 of para. [0020].

[20] Fig. 1, routers 14. See Appellant's Disclosure p. 6 lines 1-2 of para. [0020].

[21] Fig. 5, step 40. See Appellant's Disclosure p. 15 line 2 of para. [0040].

[22] See Appellant's Disclosure p. 11 line 1 of para. [0031].

[23] Figs. 3a, 3b. See Appellant's Disclosure p. 8 line 1; p. 10 line 1 of para. [0030].

[24] Figs. 3a, 3b. See Appellant's Disclosure p. 8 line 1; p. 10 line 1 of para. [0030].

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Whether claims 1-6 are anticipated by Cain (U.S. Pat. No. 4,905,233) under 35 U.S.C. § 102(b)

Whether claims 7-26 are obvious over Cain in view of Li (U.S. Pat. No. 6,381,252).

VII. ARGUMENT

A. Overview of Cain

Cain teaches identifying "feasible paths" (*i.e.*, paths with a metric that does not exceed a reference metric), and using the feasible paths "to allocate the distribution of traffic between the source node and the destination node over all the feasible paths in inverse proportion to the path metric of each respective feasible path." Cain, col. 2, lines 15-20. As a result, "loading of the feasible paths of the network is effectively balanced with minimum average delay." Cain, col. 2, lines 21-23. Cain thus teaches routing traffic based upon the current loading of a path, such routing being based upon which path has the metric indicative of the lowest delay.

Cain also teaches determining a "virtual circuit" along which to send packets and maintaining the virtual circuit "until rerouting is required, either due to a link failure along the route or due to traffic congestion." Cain, col. 2 lines 36-55.

B. Overview of Li

Li is directed to a method of managing and allocating multiple communication resources to ensure relatively equal usage. The selection of the resource is performed by retrieving a pointer value and testing the resource associated with the pointer value by monitoring the call duration over the resource. See Li, Abstract.

C. Anticipation rejection of claims 1-6

Appellant respectfully notes that independent claim 1 requires after forwarding a packet on a first link, tracking the load on the first link. Claim 1 then requires not changing the link ("preserving the link") for a subsequent packet having the same flow address if the "desired load change" of the link is determined to be less than threshold value. Appellant further notes that "desired load change" is defined in the Application as: "the load change needed to balance the loads on each path or link emerging from a router, based upon the load balancing policy in the router." Disclosure, ¶ [[0031]. Claim 1 thus requires not changing the current path or link between a source and a destination (*i.e.*, the flow address) if a determined change in the traffic loading of the path or link that is

required (in order to balance the load within a router) does not equal or exceed a threshold value. Moreover, claim 1 specifies a particular way of determining whether to preserve a link for a communication flow (comprising multiple packets).

Cain does not teach or even suggest routing based on whether the change in traffic loading that would result from a link change meets or exceeds a threshold. Cain instead teaches routing packets to the path with the lowest delay, regardless of the level of change in load that results from the routing. Further, the routing decision mechanism taught in Cain is based upon the current average delay of each path, which does not reflect the future impact of changing the routing. *See* Cain, col. 10, lines 66-67 through col. 11, line 1 ("In order to provide processing stability the traffic flow values are preferably averaged over several update intervals.").

Cain also teaches maintaining a virtual circuit "until rerouting is required...due to traffic congestion." Col. 2 lines 52-55 and col. 21 lines 55-59. However, monitoring traffic congestion does not mean that Cain's system determines whether a desired change in the load of a virtual circuit is less than a predetermined value. There may be a number of ways to monitor for traffic congestion such as examining whether the number of packets per unit time exceeds a threshold. Claim 1, however, specifically requires determining whether a change in the load is above or below a predetermined value, and that limitation is not taught or suggested by Cain.

For at least these reasons, Appellant respectfully submits that Cain does not teach or even suggest all of the limitations of independent claim 1, and thus does not anticipate claim 1 or any claims that depend upon it. Further, none of the cited art overcomes the deficiencies of Cain. Appellant thus respectfully submits that the Examiner erred in rejecting independent claim 1, as well as claims 2-6 (which depend upon claim 1).

D. Obviousness rejection of claims 7-26

Regarding the rejections of dependent claims 7 and 8 as allegedly obvious over Cain in view of Li, Appellant respectfully notes that claims 7-8 include all of

the limitations of independent claim 1. None of the cited art (*e.g.*, Li), either alone or together, teaches or even suggest all of the limitations of independent claim 1, and thus dependent claims 7-8 for at least the reasons presented above. The difference between Cain/Li and claims 7-8 is substantial. As the Board is no doubt aware, Appellant's contribution cannot be used in hindsight. Without the hindsight of Appellant's teachings (which would be improper to use), one of ordinary skill in the art would not have been motivated to use Cain's teachings of virtual circuit re-routing based on a non-specific statement regarding traffic congestion. As such, Appellant believes that claims 7-8 are not obvious over Cain in view of Li.

Regarding the rejection of independent claim 9 as allegedly obvious over Cain in view of Li, the Examiner acknowledged that "Cain fails to teach to adjust positions of one or more pointers used to partition traffic flow through a multipath network, wherein the positions of the one or more pointers are variable relative to a range of hash units that correspond to flow addresses within the multipath network." Final Office Action, p. 4. The Examiner further states that Li teaches "the use of pointers for selecting a channel," and therefore that "it would have been obvious to one of ordinary skill in the art at the time of the invention was made to use the pointers a taught by Li into the multiple path routing mechanism of Cain." Final Office Action, p. 4. Appellant respectfully traverses the Examiner's characterization of the cited art, noting that although Li does teach the use of pointers to expressly select an individual channel, Li does not teach or even suggest using one or more pointers to partition traffic flow by defining boundaries between ranges of hashed flow addresses (hash units). Although claim 9 does not expressly state that the pointers define such ranges, this is an inherent characteristic resulting from the pointer positioning required by the claim, as is clearly illustrated in Figs. 3a and 3b of the Application and the accompanying description of paragraphs [0034-0035].

The Examiner also pointed to col. 4 lines 17-54 and Fig. 3 of Li for a teaching of the limitations of claim 9. That passage, however, is silent as to pointer positions that are variable relative to a range of "hash units" that

correspond to flow addresses. Further, Appellant finds no mention in Li of any hash units used in the claimed or other manner.

Appellant submits that one of ordinary skill in the art would not have arrived at the claimed invention based on the combined teachings of Cain and Li. Because neither Cain nor Li, either alone or together, teaches or even suggests all of the limitations of independent claim 9, the cited art does not render the claim obvious. Appellant thus respectfully submits that the Examiner erred in rejecting claim 9, as well as its dependent claims.

Appellant respectfully submits that various claims that depend on claim 9 were erroneously rejected for other reasons. For example, claim 11 requires two steps of modifying a hash number-- modifying a hash number of a first pointer positioned between a highest loaded link and a least loaded link and subsequently modifying a hash number of a second pointer positioned between a second highest loaded link and a second least loaded link. The Examiner concluded Cain did not teach these limitations, but with regard to Li only stated that Li "teaches the use of pointers, a first and a second that are adjusted, for selecting a channel." Final Office Action p. 5. The Examiner did not acknowledge that the specific limitations of claim 11 were taught by Li. At any rate, Appellant does not find such teachings in Li. For this independent reason, the Examiner erred in rejecting claim 11.

A similar argument can be made regarding claim 14 which requires "program instructions for selecting a link of the multipath network to send a packet along based upon a hash number representative of a flow address of the packet and relative hash numbers of one or more the pointers." The Examiner concluded Cain was deficient for this limitation, but with regard to Li, only said that Li "teaches the use of pointers for selecting a channel." Final Office Action p. 6. Even if true, this statement about Li still does not teach the limitation of claim 14 quoted above, and Appellant finds no other teaching in Li of the quoted limitations. For this independent reason, the Examiner erred in rejecting claim 14.

Regarding the rejection of independent claim 16 as allegedly obvious over Cain in view of Li, Appellant respectfully notes that claim 16 was rejected on

grounds similar to those presented by the Examiner with regard to independent claim 9. Because independent claim 16 includes limitations similar to those of independent claim 9, Appellant respectfully submits that for at least the same reasons as those presented above with regard to claim 9, independent claim 16 is not rendered obvious by the cited art. Appellant thus respectfully submits that the Examiner erred in rejecting claim 16, as well as its dependent claims.

Appellant respectfully submits that various claims that depend on claim 16 were erroneously rejected for other reasons. For example, claim 20 requires program instructions that are executable using the processor "for accounting for the capacity of the links coupled to the multiple ports when the one or more conditions are altered." The Examiner concluded Cain did not teach these limitations, but with regard to Li only stated that Li "teaches the use of pointers that [are] adjusted to reflect the selected channel where the selected channel is from examining its status." Final Office Action p. 8. The Examiner did not acknowledge that the specific limitations of claim 20 were taught by Li. Even if the Examiner accurately described Li in the quoted sentence from the Final Office Action, that observation of Li still does not teach the quoted claim limitation as for "accounting for the capacity of the links." For this independent reason, the Examiner erred in rejecting claim 20.

Regarding the rejection of independent claim 23 as allegedly obvious over Cain in view of Li, Appellant respectfully notes that the claim has been amended to include limitations similar to those of independent claim 9. Appellant respectfully submits that for at least the same reasons as those presented above with regard to claim 9, amended independent claim 23 is not rendered obvious by the cited art. Appellant thus respectfully submits that the Examiner erred in rejecting claim 23, as well as its dependent claims.

E. Conclusion

For the reasons stated above, Appellant respectfully submits that the Examiner erred in rejecting all pending claims. It is believed that no extensions of time or fees are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional

extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 C.F.R. § 1.136(a), and any fees required (including fees for net addition of claims) are hereby authorized to be charged to Hewlett-Packard Development Company's Deposit Account No. 08-2025.

Respectfully submitted,

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VIII. CLAIMS APPENDIX

1. (Original) A method for managing traffic flow through a multipath network, comprising:

forwarding a packet along a first link of the multipath network;

tracking a load of the first link subsequent to forwarding the packet; and

preserving the first link for a subsequent packet having the same flow address as the forwarded packet upon determining a desired load change of the first link is less than a predetermined value.

2. (Original) The method of claim 1, further comprising modifying link designations to forward packets along upon determining the desired load change of the first link is greater than the predetermined value.

3. (Original) The method of claim 2, wherein modifying link designations comprises designating a second link to send the subsequent packet along.

4. (Original) The method of claim 2, wherein modifying link designations comprises preserving the first link to send the subsequent packet along.

5. (Original) The method of claim 1, wherein tracking the load comprises tracking one or more variables associated with the load of the first link.

6. (Original) The method of claim 5, wherein the one or more variables comprise bandwidth of the first link.

7. (Original) The method of claim 5, wherein the one or more variables comprise a delay of the first link.

8. (Original) The method of claim 5, wherein the one or more variables comprise a loss rate of the first link.

9. (Previously presented) A computer-readable storage medium comprising program instructions that are executable by a processor and that cause the processor to:

adjust positions of one or more pointers used to partition traffic flow through a multipath network, wherein the positions of the one or more pointers are variable relative to a range of hash units that correspond to flow addresses within the multipath network.

10. (Previously presented) The computer-readable storage medium of claim 9, wherein the program instructions for adjusting the positions of the one or more pointers comprise program instructions for modifying a position of one pointer at a time.

11. (Previously presented) The computer-readable storage medium of claim 10, wherein the program instructions for adjusting the positions of the one or more pointers comprise program instructions for:

modifying a hash number of a first pointer positioned between a highest loaded link and a least loaded link; and

subsequently modifying a hash number of a second pointer positioned between a second highest loaded link and a second least loaded link.

12. (Previously presented) The computer-readable storage medium of claim 9, wherein the program instructions for adjusting the positions of the one or more pointers are directed for use by an individual router of the multipath network.

13. (Previously presented) The computer-readable storage medium of claim 12, wherein the program instructions for adjusting the positions of the one or more pointers comprise program instructions for:

calculating an average amount of load per hash unit for individual links coupled to the router; and

calculating a desired load change on the individual links.

14. (Previously presented) The computer-readable storage medium of claim 9, further comprising program instructions for selecting a link of the multipath network to send a packet along based upon a hash number representative of a flow address of the packet and relative hash numbers of one or more the pointers.

15. (Previously presented) The computer-readable storage medium of claim 14, further comprising program instructions for hashing the flow address of the packet.

16. (Previously presented) A router, comprising:

multiple ports for coupling to links of a network; and

a storage medium comprising program instructions executable using a processor for

selectively directing a data packet to one of the multiple ports; and

altering one or more of the conditions by which the data packet is selectively directed;

wherein the one or more conditions comprise hash number values of one or more variable pointers configured to partition a range of hash numbers associated with possible flow addresses of the data packet.

17. (Cancelled).

18. (Cancelled).

19. (Previously presented) The router of claim 16, wherein the program instructions are executable using the processor for altering the one or more conditions to reflect a load balancing policy of the router.

20. (Original) The router of claim 16, wherein the program instructions are executable using the processor for accounting for the capacity of the links coupled to the multiple ports when the one or more conditions are altered.

21. (Original) The router of claim 16, wherein the program instructions are executable using the processor for altering the one or more conditions to monotonically balance loads between two of the multiple ports.

22. (Original) The router of claim 16, wherein the program instructions are executable using the processor for redirecting the data packet to another of the multiple ports upon detecting the one multiple port cannot accept the data packet.

23. (Previously presented) A network, comprising:

multiple stations configured to send and receive data packets; and

a plurality of routers interposed between the multiple stations and interconnected by a mesh of links, wherein each router is configured to

selectively direct a first packet along a link coupled thereto in accordance with one or more variable pointers included within the router; and

record the status of the one or more variable pointers to direct a second packet having the same source and flow addresses as the first packet along the same link;

wherein the one or more variable pointers are configured to partition a range of hash numbers associated with possible flow addresses of the data packets.

24. (Original) The network of claim 23, wherein each router is further configured to alter the positions of the one or more variable pointers.

25. (Original) The network of claim 23, wherein each router is configured to track the load conditions of the links coupled thereto.

26. (Original) The network of claim 23, wherein at least one router of the plurality of routers comprises a means for changing transmission control protocol connections among links of differing loss rates associated with the router.

27. (Allowed).

28. (Cancelled).

29. (Allowed).

IX. EVIDENCE APPENDIX

None.

X. RELATED PROCEEDINGS APPENDIX

None.